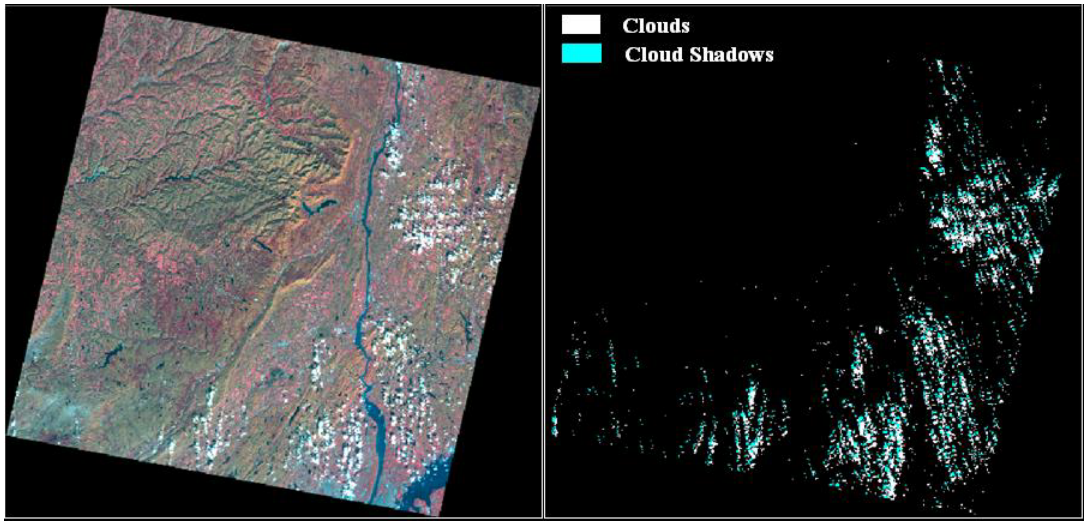
Automated, Universal Software for Cloud and Cloud Shadow Detection in RS Imagery
NASA SBIR Phase II Proposal (July 2003)



Applications: NASA and non-NASA

- Automatically update the cloud cover percentage metadata tag (QA/QC)
- Generate a cloud and cloud shadow mask as an additional layer sold to the end-user
- Reschedule failed acquisitions
- Assess cloud cover contamination in real-time mode, i.e. on board, during the data acquisition
- Substitute cloud and cloud shadow pixels representing data loss
- Develop historic cloud cover dataset with spatial and temporal resolutions higher then those currently available
- Monitor cloud cover in near-real time mode and assess its trend
- Forecast cloud cover from historic and actual cloud data
- Formulate reliable cloud avoidance strategies through complimentary use of historical and actual cloud data

Identification and Significance of Innovation / Results of Phase I

Cloud contamination remains a RS industry-wide problem with generally unsatisfactory solutions to date. Available automated cloud detection procedures (i) are limited in their per-pixel quality, (ii) rely on use of thermal and multispectral data, and (iii) are tailored to a specific sensor. These shortcomings limit their applicability to the wide range of new commercial and the next generation of Landsat imagery.

A novel approach to automated cloud and cloud shadow detection is developed by SMH Consulting. The major difference of this approach from other operational algorithms lies in its:

- Departure from exclusively spectral cloud detection
- Independence from thermal data and ability to rely on B-G-R-NIR or only B-G-R bands
- Identification of not only clouds but also cloud shadows
- Applicability to a wide range of sensors, including governmental and commercial space- and air-borne imagery.

This novel, high-performance design was completed and tested on over 150 scenes covering several different sensors, both government and commercial. A non-rigorous validation study proved the reliability and accuracy of the prototype algorithms to Landsat 5 TM and 7 ETM+ data. Overall comparison gave an 89% agreement between CASA and ACCA. Further, there was a 91% agreement between the methods within the Landsat 7 ETM+ dataset. In the majority of disagreement cases, it was found, upon visual inspection of the source imagery, that CASA outperformed ACCA.

Our innovative algorithms address the need for streamlined acquisition and automated processing of very large volumes of RS data. They fill NASA's technology needs and fit into the overall NASA mission by:

- Employing rapid analysis methodologies and algorithms
- Improving the automated process of quality assurance / quality control for science data products
- Facilitating the efficient collection of data.

Tasks to be performed in Phase II

1. System Architecture Requirements Specification
   - 1.1. Kick-off Meetings with Government and Commercial Entities
   - 1.2. Concept Development & Component Architecture Selection
   - 1.3. System Architecture Design
2. Continued Algorithm Development
   - 2.1. Algorithm Component Development
   - 2.2. Algorithm Customization/Extensions
   - 2.3. Algorithm Testing
   - 2.4. Algorithm Validation
3. System Prototype Design & Implementation
   - 3.1. Transfer of Algorithm to System Architecture
   - 3.2. User Interface
   - 3.3. Software Coding, Testing & Debugging
   - 3.4. I/O Interface Design
   - 3.5. System Speed-up
4. Final Prototype Testing
5. On-site Prototype Testing
6. Documentation

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